



Credit: Rich Griener



Credit: Harvey Buchite

Peonies From Seed



Credit: Harvey Buchite

Nate Bremer
Solaris Farms



Credit: Carsten Burkhardt

A pdf file of this program is available at:
www.solarisfarms.com , free of charge.

Why From Seed?

The only way new cultivars are made.



Credit: Nate Bremer

Credit: Nate Bremer



Credit: Nate Bremer

Why From Seed?

The challenge of growing a unique and unusual plant.



Why From Seed

Enjoyment!



Credit: Nate Bremer

Why From Seed?

Preservation of species (wild plants).



Seed Sources

Societies and plant organizations:



Membership is usually required, but dues are minimal for the return.
The access to information, knowledgeable people and material is worth it.

Recommended:

- 1) American Peony Society
- 2) Alpine Garden Society
- 3) Scottish Rock Garden Club



Societies and plant organizations are very reliable sources of properly identified and viable seed

The **American Peony Society** is one of the few sources of all kinds of peony seeds- species, herbaceous, woody and hybrids

Seed Sources

Specialty seed companies and peony growers.

1. Hidden Springs Flower Farm
2. Chiltern Seeds-United Kingdom
3. Plant World Seeds-United Kingdom
4. Others occasionally

Chiltern Seeds

Grow something new from seed

Seed companies and peony specialists are usually reliable resources of properly identified and viable seed.

Species seed is most often what is offered.

Seed Sources

Electronic commerce companies/online auction websites.

1. eBay
2. Amazon



No such thing as a yellow suffruticosa.



No such thing as a blue peony.

Electronic commerce companies/online auction websites are the least reliable source of properly identified and viable seed.

Beware of exotic claims, named colors, sources and low prices. Seeds are often not identified or misrepresented, dead, shipped from warm climates or are an outright SCAM. Chinese sourced seeds need to be approached with extreme caution.

Seed Sources

Gardeners and friends.



Other gardeners are often one of the best sources for reliably identified and viable seed.

Since you will often know these people or they are friends, special care is given to the seeds' identification and after harvest storage.

Seed Sources

Yourself.



Your careful hands are the most likely to produce the most accurately identified and viable seed-if you own fertile peonies.

If you know how to pollinate peonies, you may produce seeds with known parents, or the bees can do it for you and you'll know one parent.

Seeds may be harvested at optimum maturity and handled with the best care.

About Your Plants as a Seed Source.

Producing seeds from peonies is not difficult if you own certain types:

1. *P. lactiflora* peonies are the most common type grown in gardens and are generally good seed producers. They can be easily crossed with other lactifloras by taking pollen from one and placing it on the stigma of another.
2. *P. suffruticosa* peonies (a kind of woody or tree peony) are often very good seed producers and can be crossed with each other as you would herbaceous peonies.



About Your Plants as a Seed Source.

Cross pollination: Pollen (male cells) placed on a different plant's stigma (female receptive organ). This is the process of creating offspring with different parents and the offspring will have traits from both parents. Much like our own kids have traits of their parents, but are not copies.



X



=



About Your Plants as a Seed Source.

Self pollination: Pollen (male cells) placed on the same plant's stigma (female receptive organ). This is the process of creating offspring with one parent. Offspring are not exact copies of the parent and will often look very different. This is due to the shuffling of genes, both dominant genes and recessive genes- which may not be visible in the parent!



X



=



Pollination

Pollen (male cells)

Stigma (female receptive structure)



Credit: Nate Bremer

Stamens (filaments) & anthers
(structures that carry pollen)



Credit: Nate Bremer

Carpels...the Seed Pods of Peonies



Within the carpels are the ovaries and ovules. Ovules are the female structures that may become seed.

Seed Bearing Carpels?



● Red dots= unlikely

Seed Bearing Carpels?



Credit: Nate Bremer



Credit: Nate Bremer

- Red dots= unlikely
- Green dots= likely

Empty Carpels



Credit: Nate Bremer



Credit: Nate Bremer

Tell-tale Signs of Fertility



Bad Seed

Color, size, shape and firmness are telltale signs.



Good/Bad Seed?



Immature= will not grow



Good seed



Incomplete= will not grow

Ready for Harvest



Muslin Bags...

Muslin bags are inexpensive and very helpful in a number of regards. Bags can be wrapped and tied off over flowers to protect them from being pollinated by bees. They can be left on until seed harvest and will catch seeds, so that they do not end up on the ground. Muslin bags make an easy harvest and save seeds from being lost.



Catching the Seed





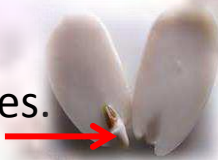
Understanding a Seed.

→Seed: a flowering plant's unit of reproduction (arising from sexual reproduction), capable of developing into another such plant. **The seedling that arises from the seed will not be an exact copy of the parent plant, as the seed is the product of two parents.**

→ Seed Coat: the protective layer that wraps around the embryo and cotyledons. In peonies the seed coat is a thick and very strong barrier. It is slowly permeable to water.



→ Embryo: The portion of the seed that will develop into roots, shoots and leaves.



→ Cotyledon: Storage vessels that are commonly the major mass of a seed. These often develop into 'seed leaves' in many plants other than peonies. The cotyledons in peonies usually stay bound up inside the seed coat, sometimes they do shed the coat to produce strap shaped leaves. *Paeonia tenuifolia* is the one exception, this species produces seed leaves from cotyledons consistently.



Considerations: Dry Seed Treatment

Recommended planting
time is late summer.

Dry seed that has been stored for some time often takes longer to germinate. Hydration of the seed is important, but so is your patience. Seed can be stored several years and remain viable, although certain types seem less inclined to grow after prolonged planting delay. Some dry seed may need to go through a second cycle of temperature changes to reduce dormancy. Giving the plants a second season may be required. Hint: never throw away seeds that remain firm, they may very well grow after repeating dormancy reduction procedures.



Dry seed will often lack a shiny luster and may have depressions or creases in them. Avoid seeds in which the coats are cracked or are being shed. Seeds that are misshapen or have sharp edges are likely dead or were never fertile.

Considerations: Fresh Seed Treatment

Recommended planting time is fall immediately after harvest.

Fresh seed is the best type to work with. Seeds are considered fresh if they were harvested in the same year of planting and have not been allowed to dry out. Fresh seed can be expected to have a better germination rate and require less time to begin their growth. This type of seed does NOT require any hydration steps before planting. Planting fresh seed within a few days after harvest increases the chances of the first leaf being produced the following spring. If it is allowed to dry too much the seed may require another year to germinate.



Fresh seed will be shiny and will have very smooth surfaces. They are often deeply colored in blue, brown and black. There will be no creases and there will be no depressions from drying. The red ovules are unfertilized and will not grow.



Seed Dormancy



Peonies produce seeds that have strong dormancy, meaning they require specific conditions to remove germination inhibitors.

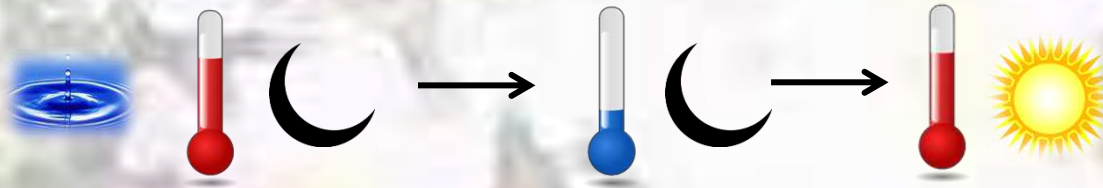


1. Physical: Peony seeds are resistant to water flowing freely into the seed through the seed coat, which can cause extremely slow germination. A certain amount of water must be present in the seed before physical and for chemical germination inhibitors to be reduced. Thus physical dormancy must be dealt with first.
2. Chemical: Peony seeds need variation in temperatures to reduce chemical germination inhibitors within the seeds. This is highly variable from seed to seed.
3. Other factors: Peony seeds, as a group, have poorly understood germination. Many experienced growers believe their complex genetic make up is responsible for the large variation in germination habits.



Germination

Peony seed requires three stages to reduce germination inhibitors.



Seeds from different kinds of peonies have slightly different requirements



herbaceous



Lutea hybrids



Rockii lineage

Seeds from the same seed pod may have variable resistance to germination as well.



Necessary Conditions: Seed Hydration

If seeds have been stored or are dry, hydration is required to begin their germination. Soak seeds in room temperature water for 3 or 4 days. Change the water daily so that seeds are not in stagnant water, where they may become infected with disease organisms.



Credit: Kevin Line

● Red dot = bad seed

At first, dry seed will often float, then become hydrated and may sink. Any seeds that are soft or do not swell can be discarded-they are not viable.

The seed with the red dot on it is not viable. The shape is too irregular and should have been culled early on. Others in this group may also lack viability. The largest, roundest seeds are most likely to germinate.

Necessary Conditions: Warmth

Step 1: All peony seeds need a period of approximately 60 to 90 days of temperatures that range from 70°F to 80°F degrees Fahrenheit, after hydration. **A temperature of 72°F to 75°F works well.** This is the first reduction of chemical dormancy. Often at the end of this cycle the seeds will begin root growth.



*If seeds are planted outside, they will be subjected to variable conditions. This should not be of concern, natural cycles work very well for germinating peony seed.

Necessary Conditions: Cold

Step 2: All peony seeds need a period of approximately 60 to 90 days of temperatures that range from 34°F to 50°F degrees Fahrenheit, after a warm cycle. **A temperature of about 42° to 45°F works well.** This is the second reduction of chemical dormancy. As temperatures are reduced some seeds will also initiate root growth. Those that produce no root growth will need to go through another (or even more) warm-cold cycle(s).

Crisper drawer in refrigerator

Garage (freeze?)

Mulched bed under plastic

Enclosed porch

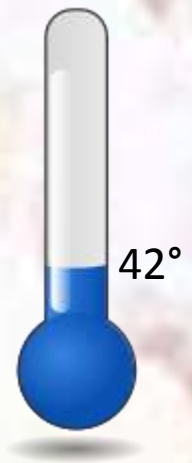
Mini fridge

Cold room in basement

Root cellar

Buried in the garden outside

*If seeds are planted outside, they will be subjected to colder conditions. This should not be of concern, natural cycles work very well for germinating peony seed.



Necessary Conditions: Warmth

Step 3: Peony seeds that have developed a root require warming temperatures to initiate stem and leaf growth. This stage is much the same as the first, but the plants will finally emerge and begin to grow their first leaf, if dormancy was reduced in the other stages. Light will be required as soon as leaf growth begins.



72°

Window Sill

Cold Frame

Outdoors in full sun, if started in a bed

Greenhouse

Outdoors in semi-shaded location

Grow light setup

*If seeds are planted outside, they will be subjected to a wide range of temperatures. This should not be of concern, natural cycles work very well for germinating peony seed.

Planting Options: Media and Soil

There are numerous options to germinate peony seeds. All involve the use of some type of media or soil. In all cases the media must drain well, while holding a small amount of moisture. If starting seeds inside, a sterile media is best. A good garden soil that drains well works for outdoor seed starting. Avoid garden soil for indoor starts.

Vermiculite



Perlite



Milled Peat



Potting Soil



Pit or shore sand



Garden Soil



Planting Options: Pots

Indoor germination

Peony seeds may be directly planted into pots. Use of a potting soil is recommended if you intend to keep the plants growing in the container through a number of temperature changes that need to be made. Pre-germinated seeds may be planted into pots. Deep pots are best, as peonies make long root systems.



Plastic pots are fine, but do not 'breathe' and you will need to take care not to over water.

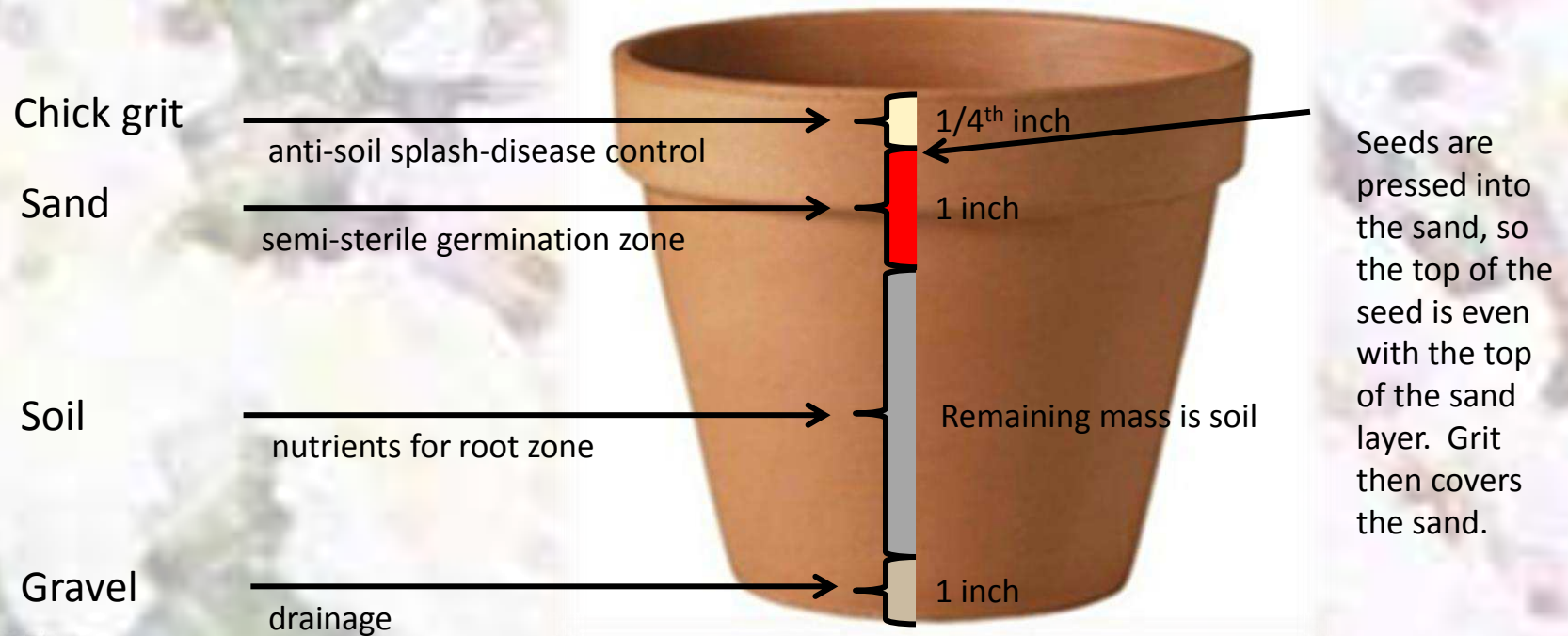
Hint: Enclose the pot in a plastic bag and seal. This will prevent evaporation and you need not add additional water.



Terracotta or clay pots 'breathe' and regulate moisture very well. Placing gravel in the bottom and setting the pot in a shallow dish of water will keep it evenly moist.

Planting Options: Media Techniques in Pots

Indoor germination



Gravel

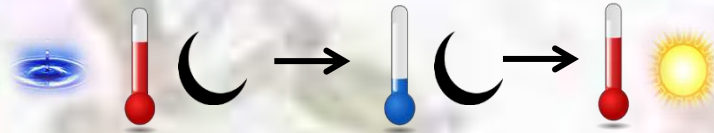


Chick Grit is usually made from ground limestone or oyster shells and can be purchased at local feed mills or pet stores in small amounts. Other small aggregates may be substituted. The stem area of the emerging seed is an area that is susceptible to rot, small aggregates keep soil borne disease from splashing on the stems and keep them relatively dry.

Planting Options: After Treatment of Pots

Indoor germination

Once seeds have been potted and water has been allowed to completely drain from the pot, we recommend enclosing the pot in a bag. No extra water will likely be needed until plants begin to emerge after dormancy reduction cycles. When plants emerge, light will need to be supplied and the bag can be partially opened to supply fresh air, or can be removed completely.



Credit: Nate Bremer



Credit: Nate Bremer

Planting Options: Seedling Growth in Pots

Indoor germination



Credit: Dick Westland



Credit: Harvey Buchite

Plumules



Credit: Rich Grenier



Credit: Dick Westland

Planting Options:

Potted Seedling Summer Care

Indoor germination
moving outdoors

Pots with seed or seedlings can be sunk into the ground in the spring. These pots may be left in place for 2 years, until the seedlings are large enough to transplant into the garden. Make sure to bury the pots so the rims don't catch water. Some summer watering may be necessary if condition become dry.



Credit: Rich Grenier



Credit: Rich Grenier

Planting Options: Wooden Flats or Boxes

Indoor germination

Wooden flats or boxes are the preferred container for starting any seeds that are to be germinated indoors. They are unfortunately large and may not be the right 'fit' for the grower. These containers 'breathe' very well and soil medias tend to stay evenly moist, more so than other starting methods. The plants can be taken through all dormancy reduction cycles without moving them and be grown on until transplant in the garden. Fill the box with the same media and proportions as you would a pot.

This box is 8" high x 12" wide x 24" long



Credit: Nate Bremer



Gravel



Pit or shore sand



Planting Options: Wooden Flats and Boxes



Boxes can be sunk into the ground like the pots. We remove the seedlings in the spring and plant them in the garden.

Indoor germination



Wooden containers are treated the same way as pots during dormancy reduction cycles. While we plant most types of peony seeds outside, the lutea hybrids are grown from seed in these boxes, indoors. Lutea hybrids appear to need a longer initial warm period, thus the indoor treatment.



Planting Options: Plastic Bags

Indoor germination



Plastic bags are good option for getting seeds to root. Bags are easily handled and can be kept in small spaces during the dormancy reduction cycles, but will require individual seeds to be planted in soil for further growth.

Vermiculite



Credit: H.S. Spino Contracts Pvt. Ltd.

Planting Options Plastic Bag Media

Pit or shore sand



The media used in plastic bag germination is one that should hold water, yet have adequate air spacing between particles. No nutrient value is needed as seeds are not grown in the material-it is only used to start the seeds. Once plants have roots, or are beginning to show signs of stem/leaf formation, they need to be transplanted to a pot or planted in the garden.

While using bags to get seeds started works, there are dangers to the seeds. The media must not become saturated with water (needs to be damp) or roots rot. Remember too much water is the peonies greatest enemy! Vermiculite is the recommended media for this type of treatment.

Indoor germination

Perlite



Credit: IPS Madendik

Milled Peat



Credit: Peaceful Valley Supply

Potting Soil



Credit: Fafard Soils

Planting Options:

Bag Seed Growth Examples

Indoor germination



Easiest method!

Planting Options: Outside-Natural

Outdoor germination



Seeds may be planted outside in finely tilled beds or small garden plots. Seeds are pressed into the surface and soil is firmed. Wood mulch is then applied to a depth of no more than 1 inch to cover the soil surface. When planted in the fall season (fresh seed) it is important to warm the planting area and keep it warm. Plastic sheeting or old windows on a cold frame accomplish this nicely. If conditions are met new seedlings will emerge in the following spring. Some types will require another year to make themselves known.



Planting Options: Outside-Natural

Outdoor germination

The following spring, the covers on the cold frames or plastic is removed as soon as possible. This is done as soon as the winter snow has melted. Pay no attention to ice or snow storms that follow in the spring, the little plants that have not yet emerged will arise when temperatures are right. Caution: leaving covers on planting beds too late will promote the growth of the little seedlings before the weather is warm enough for their first leaves to survive. Better to remove the covers early than late!

Mulch covered seed bed after removal of cover in spring.



Seedlings in spring upon emergence



Seedlings in cold frame upon emergence.



Planting options: outdoor seed growth examples

Outdoor germination



3 year old rockii lineage plants
in foreground, background are
herbaceous seedlings.



3 year old herbaceous
seedlings in a bed that was
covered in saw dust.



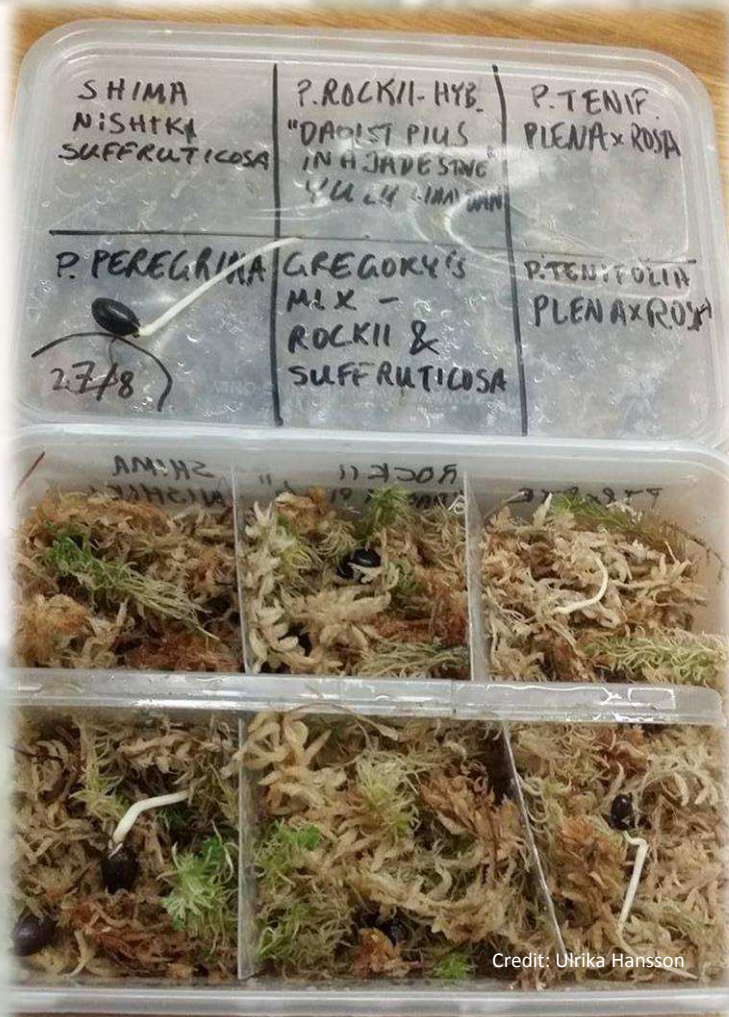
3 year old
specialty crosses-
herbaceous.



Planting Options: Alternatives

Starting seeds in a plastic box with raw sphagnum moss. There are many small containers available at very low costs or even recycled ones that would be useful for this type of germination. The boxes or cells within the box are lined with damp sphagnum moss, seeds are set on top of the moss and the lid is sealed. The entire box can be taken through the first two steps of dormancy reduction in a nice clean fashion. Seedlings would need to be planted in soil as soon as stem formation begins.

We've never used this method, but it makes perfect sense and appears to be a viable method.



Planting Options: Alternatives



Bulb or milk crates make excellent planting boxes to start seed and then grow it for a couple of years. To use this method line the boxes with a few layers of newspaper or cardboard and then fill it with the same components as the pot method. Plant the seeds the same way and cover with chick grit. We recommend that once the boxes have seeds planted that they be enclosed in a plastic bag, so watering is not an issue while the seeds germinate.

The above plants were moved outside in their crates and placed on the soil surface in a garden. The roots grew through the spacing in the bottoms of the crates and into soil! Best to not leave them too long!

Growth Progression: Seedling Growth in the First Year

0-3 months

3 to 6 months

6 to 10 months



Hydrated
seed



Root growth
from cotyledon

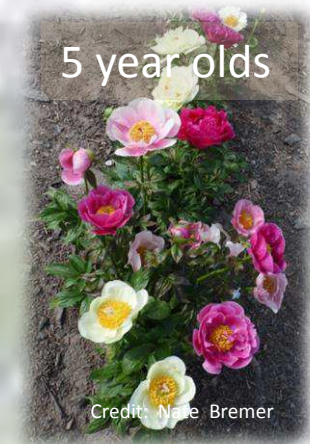


Cleft at top
of root forms
and stem arises



Stem and plumule
for the first
growing season

Growth Progression: Seedling Growth in the Following Years



Time Requirements for Plants to Flower



Most peonies will bloom from seed in approximately 3 to 7 years. The majority will bloom in year 4 or 5. Certain types of woody peonies (lutea hybrids) often begin blooming in year 3 and 4. Seedlings that receive full sun and adequate water during the growing season will grow more quickly and produce enough root mass to flower at the earlier segment of this timeline.



General Guidelines

- | | | |
|-------------|---|--|
| Year 1 | → | plumule |
| Year 2 | → | 1 stem with a couple leaves |
| Year 3 | → | 1 or 2 stems with a few leaves |
| Year 4 | → | 1 to 3 stems with more leaves and sometimes a poorly formed flower |
| Year 5 to 7 | → | 1 to 5 stems with sub-adult number of leaves and more normal flowers |

After Care

1. Light: Semi-shade for the first year is best for plants started indoors. Plants started in the garden can receive full sun immediately.
2. Water: Keep evenly moist during their first growing season. Never wet, better to err on the dry side.
3. May be fertilized with a low percentage N-P-K (Nitrogen-Phosphate-Potassium or Potash) fertilizer: Milorganite (5-2-0) or bulb fertilizers (4-10-6). Slow release fertilizers work well so tender roots are not burned. Do not over fertilize as first year peonies are not heavy feeders.
4. A light wood chip or bark mulch is beneficial as there appears to be useful nutrients in the decay of wood based products and this will also keep soils evenly moist and at an even temperature.
5. If plants are started in pots or in other containers it is important to get them growing outdoors as quickly as possible so that they become synchronized to the climate.
6. Protection from windy locations is important as the first young leaf is easily damaged and this is the plants only way to make energy for the coming year.
7. In year two and there after, full sun and even moisture will help them to grow to their fullest potential.

Disease

Disease is one of the major enemies of young peonies. These diseases are usually fungal or bacterial in nature.

Causes are usually too much water or lack of air movement. These problems are generally found with indoor germination procedures.



Seedlings that wilt or have black stems near the surface are signs that disease has made it's way into the plants. Root rots may occur, which are not as visible. These are all likely due to overwatering or lack of air movement.

Considerations: Rockii Lineage Peony Seed

Woody Peony:
stems persist
through the
winter



Paeonia rockii is a species from China and it has been hybridized with the more common *P. suffruticosa* woody peonies. This is important because *P. rockii* possesses hardier traits and is a more disease resistant plant. Plants that have *P. rockii* in their genetic background tend to be more resistant to cold and the common peony disease botrytis.



Seeds are easy to grow, but often require more time than other peonies to germinate. We plant fresh seed in the fall, but only a minor percentage of seed germinates to show plumules the following spring. A year later nearly all of the seeds will have germinated and developed their first leaf. A smaller percentage may germinate 3 to 4 years after planting. The seeds are durable enough to be expected to grow outside without much pampering and once started, have excellent growth rates. The extra time required to grow *P. rockii* lineage plants from seed is well worth it, since nearly all seedlings will have attractive flowers.

Considerations: Lutea Hybrid Peony Seed



Lutea hybrids are a cross that involve two species-*Paeonia delavayi* and *Paeonia suffruticosa*. While this hybrid group has been around for nearly 100 years, it is finally making it way into more gardens. Acquiring seed is usually difficult due to fertility problems in the group, but advanced generation plants are showing more promise in seed production. These plants are somewhat less woody than the other 'woody peonies', but growth rates are faster. The flowers in this group are unique for color-reds, pinks, yellows, golds, peach and a myriad of blends may be seen. If you can locate seed for purchase, plan to pay \$4.00 to \$10.00 per seed!

Growing these from seed is not difficult, but some special considerations need to be made. We have attempted to germinate seed from these in outdoor plantings and have had little success (Wisconsin, USA). Indoors they are relatively easy using the bag, pot or box treatment. Seeds develop roots over a longer period of time and thus may require an extended initial warm period to reduce dormancy. 3 to 4 months may be required in the first cycle.

Herbaceous:
Plants die to
the ground
annually.

Considerations: Herbaceous Peony Seeds

Herbaceous peony seed is the most commonly available type. The seed comes from plants that we are most accustomed to seeing in our northern gardens, but the range of flower forms, color and plant habits are wide. Seed for species is often available from companies, but tend to be the most challenging to grow. *P. lactiflora* and herbaceous hybrid seed is typically easy to grow and success is likely. Any of the germination techniques work well for this group, but we recommend starting them outdoors. The seeds are durable and will usually come up the following spring after planting in fall. If started inside, be prepared to give them good light and air movement once they begin the growth of their plumules (growth rate is very fast). Many herbaceous seedlings are lost indoors due to disease, thus the outdoor treatment is preferred.



Common Errors and Troubles



1. Not labeling/keep seeds identified. Most people think they will remember or aren't really concerned about identity. Unfortunately, most people will forget or later regret not knowing what their plants are. Markers can be made of many things. A wax pencil and plastic or aluminum stakes work well for at least the first couple of years.

2. Overwatering. Peonies require very little water and are best if grown on the dry side. Overwatering is usually a problem for people that grow their plants in pots and rely subjective watering practices. Placing the pot in a bag after the correct media hydration is completed is a good tactic to avoid this problem.

3. Rotten root systems on germinated seeds. This is usually due to overwatering. Once roots are lost, the small plants usually have a difficult time replacing them. Solution: plant more seeds and use less water.

Common Errors and Troubles

4. Insufficient time in one of the dormancy reduction cycles. The first and second periods of time in dormancy are most important. It is best to give seed the full period of time or even a bit more during these periods. Many ungerminated seeds will be seen if too little time is given.
5. Too much handling or digging around to look at the seed (I'm guilty of this). Avoid looking at the seeds and handling them. Let nature take its course and trust that they will grow-handling and looking won't help them.
6. Damaging climate and locations once planted outside. In the first year most peonies will only produce one leaf (plumule) and this is its only source to carry out photosynthesis. Its important for the little plants to keep this leaf as long as possible, so that they can produce enough energy to grow larger the following year. Protect the small seedlings outside by placing a box with fine wire mesh over the top. This will protect them from wind, heavy rain, hail, critters and excessive sunlight. The box will also help prevent them from being stepped on. The box can usually be removed after the first year of growth.

Common Errors and Troubles

Root rot and foliar disease is a very frustrating problem for indoor seed starting and the problem can be reduced using fungicides. Many fungicides are available, but are not particularly easy on the environment and may have some toxicities. One fungicide that may be of interest is an organic formulation that can be purchased online or at well stocked garden centers (Actinovate). While we have not used this product we know of another hybridizer who has and experiences great success with it.



Credit: Pinetree Garden Seeds

Actinovate prevents and treats lawn, root, and foliar fungal diseases such as Pythium Blights, Powdery Mildew, Leaf Spots, Rusts, and many others. It contains a high concentration of patented beneficial microorganisms that create a mutualistic relationship with your plants, feeding off of the plant byproducts and protecting them from disease pathogens. **Actinovate** is water-soluble and can be used on vegetables, herb gardens, annuals, perennials, trees, shrubs and hydroponics.

What Dreams are Made of...

Few other plants equal peonies for beauty, interest and longevity. While growing them from seed may appear laborious, there is little doubt that the gardener that pursues this activity will be gratified completely. Most peonies raised from seed are nothing special, but many are attractive and will be special to the grower. No one else in the world will have an exact copy and you may even end up with next award winner!



More Dreams...



Thank You and Good Luck!

Many lessons are learned in growing peonies from seed... Patience, observation skills, experimentation, problem solving, planning, organization and personal satisfaction. All great opportunities for our personal toolboxes! Enjoy and grow something NEW.



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